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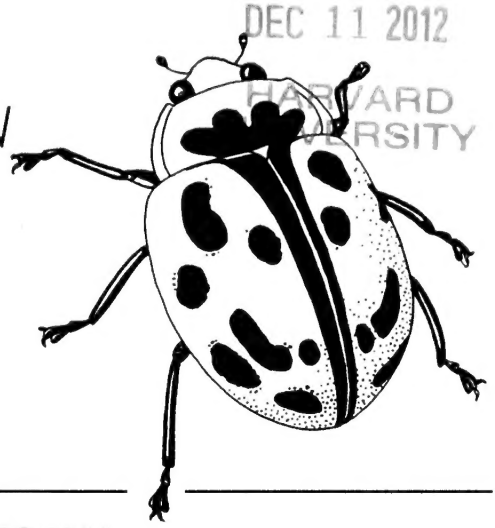
INVERTEBRATE CONSERVATION NEWS



No. 69, October 2012

EDITORIAL

This issue of *ICN* is perhaps more than usually full of doom and gloom, since it includes certain reports that help to confirm an impression of widespread decline in the abundance and diversity of invertebrates. Although there is plenty of depressing news about threats to the invertebrate fauna, it is perhaps encouraging that some of this has been reaching the headlines, at least here in the UK.

Although invertebrates are evidently more in the news these days, very few radio or television journalists seem to have the knowledge necessary to question politicians as rigorously on matters of conservation policy (especially in relation to the less glamorous parts of our fauna) as they do on matters of mainstream politics. How refreshing it would be if government ministers could be held to account for the inadequacy of their response to evidence of serious harm from pesticides or for their eagerness to allow the obliteration of the rich biodiversity that has been recorded on many so-called brownfield sites.

NEWS, VIEWS AND GENERAL INFORMATION

New report on predicted extinction rates of invertebrates

One fifth of the world's invertebrates could be heading for extinction according to a report published in August by the Zoological Society of London (ZSL), in conjunction with the International Union for Conservation of Nature (IUCN) and the IUCN Species Survival

Commission. More than 12,000 invertebrates on the IUCN Red List of Threatened Species are reviewed by the authors, who found freshwater species to be under the highest risk of extinction. The findings from this initial group of global, regional and national assessments provide important insight into the overall status of invertebrates. Together they indicate that the level of threat to invertebrates is probably very similar to that of vertebrates and plants.

Perhaps in order to encourage policy-makers and others to realise that invertebrates merit a fairer share of the conservation cake, the authors of this strikingly illustrated report quote numerous astonishing 'invertebrate facts and figures', many of which will be broadly familiar to those of us who have long been aware of the immense diversity and ecological importance of invertebrates, as set against the relative lack of attention that has been paid to them in conservation. For example, invertebrates are stated to *"contribute a staggering 80% of species to the world's known biodiversity"*. From an ecological perspective, invertebrates are portrayed as "*our natural capital; the engineers of the many benefits which humans accumulate from an intact and fully functioning environment*".

Some of the facts stated about individual species might surprise readers who think of invertebrates as all being small and short-lived. For example, the authors mention that giant squids *Architeuthis* spp., the world's largest molluscs, can reach over 10 m in length and that the oldest clam ever found was estimated to be about 400 years old. Among native British species, the Pearl mussel *Margaratifera margaratifera* is stated to be capable of living for 190 years.

ICN readers will be sadly familiar with the threats to invertebrate populations. The examples mentioned in the report include river pollution from agricultural sources and dam construction, which seriously harms molluscs such as thick-shelled river mussels. Another freshwater example concerns crayfish such as the Noble crayfish *Astacus astacus*, which are at risk from the impact of invasive species and diseases.

With regard to the scale of the threats to invertebrate populations, the authors concede that the available statistics are limited. They point out that, for vertebrates, an overall decline of 30% in populations has been reported since 1970, but that no comparable figures are available for invertebrates in general. Taking pollinators as an example where figures are available in certain parts of the world and taking account of the "*obvious effects on ecosystem stability, crop production and food security*", they draw some worrying conclusions about invertebrates in general. They point out, however that the levels of threat and

extinction rates are not uniformly distributed across species and space, if vertebrates are anything to go by. They cite evidence, for example, that vertebrate population declines have been by far the greatest in tropical and freshwater systems and that the percentage of amphibians at risk (40%) is much higher than for most other vertebrate groups.

Although the authors were not in a position to quote general statistics for many invertebrate groups, their study of available data has led them to conclude that the level of risk both for invertebrates and vertebrates is related to the mobility of the species concerned and the kinds of habitat that they require. For example, about one third of species both of amphibians (vertebrates) and freshwater molluscs (invertebrates) are thought to be at risk. In contrast, a lesser figure of about one tenth of species applies both to birds and to relatively mobile invertebrates such as dragonflies and butterflies. In general, the authors conclude that "*freshwater species are consistently at higher risk than their terrestrial counterparts*".

The report mentions a number of initiatives that could help redress the lack of information about most taxonomic groups of invertebrates. These include a programme to update the IUCN Red List under the IUCN Invertebrate Conservation Sub-committee, established in 2005, which comprises representatives of the invertebrate specialist groups within the IUCN Species Survival Commission. Also, with an ecological and regional approach, the IUCN Freshwater Biodiversity Unit is carrying out comprehensive Red List assessments for key groups of freshwater species, including invertebrates such as dragonflies and molluscs, in order to identify "critical sites" for their conservation. For example, such assessments have been taking place across Africa, the Eastern Himalayan region and Indo-Burma.

For marine species, the IUCN Marine Biodiversity Unit is conducting the Global Marine Species Assessment, the first global review of the threat of extinction to every marine vertebrate species, plants and selected invertebrates, including reef-building corals. IUCN is also helping other organisations with their existing projects, for example on cone snails *Conus* spp. The report states that Marine Protected Areas cover less than 3% of the ocean.

Although efforts to review Red Lists have been stepped up, the authors concede that the process will often be too slow to meet urgent needs for identifying appropriate conservation measures. For this reason, shortcuts are being developed, using indicator species. This has, for example, been attempted for freshwater molluscs, dragonflies, dung beetles, butterflies, crayfish, freshwater crabs, reef-building corals and cephalopods.

For invertebrates on the existing IUCN Red Lists, the authors have ranked the main categories of threat according to the number of species that are at risk from each of these categories. On this basis, the most serious threat is from infrastructure development, followed by pollution, invasive alien species and climate change. Interestingly, habitat loss owing to forest logging is fairly low in this ranking.

The report includes chapters in which several contributing authors review the status of marine invertebrates and terrestrial invertebrates. It ends with a chapter by Michael J. Samways and Monika Böhm, reviewing the prospects for developing an effective strategy for invertebrate conservation.

Reference

Collen B., Böhm M., Kemp R. & Baillie J.E.M. (2012). *Spineless: status and trends of the world's invertebrates.* Zoological Society of London, UK, 86 pp.

Further news of ash dieback in the UK

As reported in *ICN* 68, ash trees affected by a lethal disease have been imported into the UK, following the westward spread of the causal fungus across Europe in recent years. In some of the countries affected, such as Denmark, the disease has killed up to 90% of ash trees. Following our initial report, which was based on an interception of plants that had arrived from the Netherlands, further cases of the disease have been found on imported trees that had already been planted at several sites in England and Scotland. Also, at the time of going to press, the causal fungus, *Chalara fraxinea*, has just been detected on pre-existing ash trees at one site, this being in woodland in East Anglia.

Provided that the fungus has not widely spread from the initially imported trees, an import ban could help to prevent devastation of the populations of one of the UK's main native tree species, with very serious consequences for dependent invertebrates. Regrettably, however, the UK government initially took the view that an import ban would not be permitted under European plant health regulations. There is, however, a clause in the regulations that allows EU member states to impose such bans on an emergency basis, while the case for a long-term ban is assessed in detail. Following pressure from various individuals and organisations, including the Woodland trust, the UK Environment Minister, Owen Paterson recently announced that an import ban, together with a moratorium on movement of ash plants,

could be imposed by November. The latest news, however, seems to be uncertain. The restriction on movements seems certain to be imposed but the status of the ban is not yet clear.

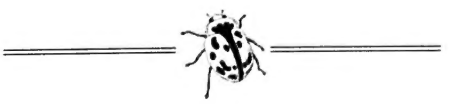
Pictures illustrating the disease, which kills leaves and shoots and then causes progressive dieback of an affected tree, can be seen at the Forestry Commission website: at: www.forestry.gov.uk/chalara

Suspected occurrences should be reported to one of the following: Forest Research Tree Health Diagnostic and Advisory Service (tel. 01420 23000); Forestry Commission Plant Health Service (tel. 0131 314 6414) or Fera Plant Health and Seeds Inspectorate (tel. 01904 465625).

Another "killer shrimp" introduced to the UK

Following the introduction of the "killer shrimp" *Dikerogammarus villosus* to England and Wales (see *ICN* 68 about its spread to the Broads of East Anglia), a similar species *D. haemobaphes* has been found in the River Severn at Tewkesbury, Gloucestershire and Bevere, near Worcester. It has also been found in the Staffordshire and Worcestershire Canal and the Worcester and Birmingham Canal, covering a distance of approximately 23 miles (38 km). According to the Environment Agency (EA), these sightings, made during routine monitoring, are the first in the UK.

The EA is treating the shrimp as a "high impact species", observing that, in Europe, it "kills and competes with a range of native species" and scavenges and eats plant matter, which "alters the ecology of the habitat". The potential impact of the species is, however, uncertain, since it is thought to be less aggressive than *D. villosus* and is somewhat smaller, growing up to about 18 mm in length. It does, however, breed rapidly, producing three generations per year, with each female laying 100 or more eggs. Also, it is better adapted than *D. villosus* to soft surfaces and is therefore likely to colonise a different range of sites. Its natural distribution, the Ponto-Caspian region of eastern Europe around the Black Sea, is similar to that of *D. villosus*.



SITES AND SPECIES OF INTEREST

Fairy Shrimp at Imber, Salisbury Plain

The 2012 edition of *Sanctuary* magazine (No. 41), published by the UK Ministry of Defence, reports the results of a long-term detailed study of the Fairy shrimp *Chirocephalus diaphanus*. This crustacean, which is protected under the Wildlife and Countryside Act 1981, is the only extant British species of fairy shrimp. Its body is translucent and reaches about 13 mm in length. It requires water bodies that are free from species that could prey upon it and it is therefore typically confined to temporary pools that dry out often enough not be colonised by such predators. It produces eggs that tolerate drying out and that hatch on re-wetting, then developing very quickly to continue the life cycle.

The study, by Iain Perkins, was designed in order to investigate the distribution of the shrimp on Salisbury Plain, Wiltshire in southern England and to determine its mechanisms of dispersal and its requirements for optimal habitat development.

Three potential passive dispersal mechanisms were investigated: involving vehicles, animals and the wind. Vehicles were not found to play a major role in dispersing the shrimp but they proved to be important in creating temporary ponds through repeated track use, causing the formation of relatively large pools. The study did, however, confirm that the eggs of *Chirocephalus diaphanus* can be dispersed both by animals and the wind. It is believed that these findings might assist in the conservation of the species in the advent of future changes in land management and climate.

Brownfield butterflies in Staffordshire, England

In the UK, the long-term use of large areas of land by the Ministry of Defence (MoD) has often helped to conserve habitats that have been fragmented and often destroyed in the wider landscape. Many of these, such as heathland and chalk downland, are effectively 'greenfield' land but other MoD areas have been used for military installations and have 'brownfield' characteristics. It is therefore interesting to read about such an area that is exceptionally valuable for butterflies, as reported by John Bryan of Butterfly Conservation in the MoD's *Sanctuary* magazine, No. 41, 2012.

The report concerns a site in the north-west Midlands of England; the Swynnerton Training Area in north Staffordshire. The site has been the

subject of controversy, having been used as an overnight store for nuclear weapon convoys in the 1980s. Previously, it housed a massive ordnance filling factory, which was developed in World War II and employed 18,000 people at its peak. The factory closed in 1958 and was handed to the army, which developed a training base that is still in use. The factory used to have various outbuildings and an extensive railway network but only a few foundations and revetments now remain and are starting to be reclaimed by nature, forming extensive areas of brownfield habitat amongst 230 hectares (568 acres) of open damp woodland, grassland, meadows, a lagoon and the River Meece. As at other MoD sites, the flora of these areas is far richer than that of the land outside the perimeter fence, owing to the lack of agricultural management and the non-use of fertilisers and insecticides.

Butterfly Conservation has been surveying the site and, in 2011, found that both the brownfield areas and the herb-rich meadow were supporting species that are rare or in decline elsewhere in Staffordshire or on a national scale. The Nationally Notable moth the Marsh pug *Eupithecia pygmaeata* (a day-flying species) was found in one of the damper meadows and the first scheduled moth trapping session produced 84 species, including the micro moth *Spuleria flavicaput* (larval foodplant hawthorn), which had last been recorded in the county in 1950.

The site was found to support metapopulations of certain butterfly species that are declining nationally. These were the Brown argus *Aricia agestis* and the Dingy and Grizzled skippers *Erynnis tages* and *Pyrgus malvae*. The Dingy skipper and its larval foodplant, common bird's-foot trefoil *Lotus corniculatus*, were found to be especially favoured by brownfield features such as overgrown car parks and old foundations. The Grizzled skipper was found to prefer the sunny flower-rich roadside verges with their short sward, this habitat being provided by a sympathetic mowing regime carried out under estate management.

As mentioned in an earlier report by Butterfly Conservation (see *ICN* 53), the Dingy skipper has something of a brownfield stronghold in Staffordshire, occurring in the city of Stoke-on-Trent, at old colliery sites and at Huntington Gravel Pits in the Cannock area. The Grizzled skipper is arguably less of a 'brownfield butterfly' and has not fared so well in the county. Its discovery at the Swynnerton Training area is highly significant, since it has always been rare in Staffordshire, not having been found in the north of the county for more than 20 years previously and having been recorded only in 15 localities in the entire county.

RESEARCH NOTES

Declining ground beetle populations in the UK

A report from Rothamsted Research has revealed evidence of a decline in UK populations of ground beetles (family Carabidae). These beetles play an important role in many terrestrial ecosystems, mainly as generalist predators of other invertebrates, including many that can attain pest status in agriculture. Since carabid populations are less subject to weather-related fluctuations than those of certain more popular taxa such as butterflies, they can be regarded as potentially very useful indicators of 'ecosystem health'. They have, however, been rather neglected in long-term surveys.

The Rothamsted report describes the first long-term, wide-scale and quantitative assessment of temporal changes in UK carabid communities. This could be valuable in identifying national strategies for conservation management. The research team used multivariate and mixed models in order to assess species diversity and population size over a 15-year period at eleven sites in the UK Environmental Change Network. The sites included pasture, field margins, chalk downland, woodland and hedgerows in the lowlands, moorland and pasture in the uplands, and grassland, heaths and bogs in montane locations.

The survey showed substantial declines in the populations of three-quarters of the species studied. In half of them, the rate of decline was greater than 30% over a ten-year period. The authors of the report point out that such declines are comparable to those reported for butterflies and moths and that they give similar cause for concern.

As far as different habitat types were concerned, the greatest decline in the population size of carabids occurred in the montane sites, where it averaged 52% for all the species concerned over ten years. The corresponding figures were 31% in northern moorland sites and 28% in western pasture sites. In each of these cases, at least 80% of the species declined. At one site, however, on downland in the south of the UK, the corresponding average change was an increase of 48%. Populations in the woodland and hedgerow sites were mostly stable. Also, biodiversity was maintained overall in the upland pasture.

This study demonstrates the value of monitoring the status of invertebrates that show steady trends in their population size. It also helps to remind us of the importance of such species in providing 'ecosystem services'. Further studies of carabid beetles and of other

widespread and ubiquitous taxa would help in the understanding of the causes of loss in biodiversity, involving interactions between habitat structure and factors such as climate change and the use of pesticides.

Reference

Brooks, D.R, Bater, J.E., Clark, S.J., Monteith, D.T, Andrews, C., Corbett, S.J., Beaumont, D.A. & Chapman, J.W., (2012). Large carabid beetle declines in a United Kingdom monitoring network increases evidence for a widespread loss in insect biodiversity. *Journal of Applied Ecology* **49** (5), 1009–1019.

Neonicotinoid and other pesticides: further evidence of harm to bees

As reported in earlier issues of *ICN*, there is evidence that various pesticides are more harmful to non-target invertebrates than is indicated by conventional safety tests. Such tests do not usually provide an adequate assessment of sub-lethal effects, which can include behavioural disturbances or an impairment of fecundity. An additional possibility is that a pesticide can act synergistically with other pesticides or with other factors such as disease, thus causing more harm to non-target species than might otherwise be predicted. It is clearly important for pesticides to be tested for such effects and for policy-makers and regulatory bodies to take account of all the available information.

As mentioned in *ICN* 64, an American research group has found evidence of sub-lethal effects of a combination of the neonicotinoid pesticide imidacloprid, and a microsporidian parasite, *Nosema* in honeybees. Further evidence of a sub-lethal effect has now been found in bumblebees by a research group at the School of Biological Sciences at Royal Holloway, University of London. Their research was conducted under the Insect Pollinators Initiative, which is joint-funded by the Biotechnology and Biological Sciences Research Council, Defra, the Natural Environment Research Council (NERC), the Scottish Government and the Wellcome Trust. It is managed under the auspices of the Living with Environmental Change (LWEC) partnership.

The study at Royal Holloway involved the exposure of bumblebee colonies to two commonly used pesticides, imidacloprid (as in the American study) and a pyrethroid, λ-cyhalothrin. The concentrations of these pesticides were set at levels thought to be frequently encountered by bees foraging in the field.

The pesticide combination was administered to 40 early-stage bumblebee colonies over four-weeks, during which the foraging

behaviour of the bees was monitored with radio frequency identification (RFID) tagging technology. Untreated colonies were monitored for comparison. The bees in the treated colonies were less efficient at foraging, especially for pollen, so that the food supply to the colonies was reduced. As a result, the colonies raised fewer new workers than the untreated ones. Also, the loss of workers through failure to re-locate the colony after foraging was 55% greater in the treated colonies.

Earlier this year, the results of other research at the Harvard School of Public Health, USA, fuelled suspicion that neonicotinoids are involved in the colony collapse disorder (CCD) of honeybees, a widespread and largely unexplained dying-out of colonies in North America and Europe. As reported on the Wired Science website, Chensheng Lu and co-workers caused controversy when they reported that they had artificially reproduced CCD by exposing honeybee colonies to imidacloprid.

The Harvard team reasoned that honeybees in the USA are exposed to neonicotinoids, not only as a result of foraging for nectar and pollen but also when beekeepers provide supplementary feed in the form of corn syrup, manufactured from neonicotinoid-treated maize. The team obtained twenty commercially available colonies and divided these into four groups, each of five hives. In the summer of 2010, they fed the bees different amounts of imidacloprid, ranging from zero, through 20 parts per billion, to 400 parts per billion.

During the following winter, fifteen of the sixteen hives that had received imidacloprid showed one of the main aspects of CCD; i.e. the abandonment of colonies by worker bees. Other signs of CCD were, however, not observed and this failure to reproduce CCD in all its aspects has been criticised, especially by Bayer CropScience, the manufacturer of imidacloprid and the founder of "Bayer Bee Care Centers" in Germany and the USA. Arguing that the findings were "seriously flawed", Bayer has argued also that the experimental replication was inadequate and that the imidacloprid concentrations selected for testing were far higher than would have been found in high-fructose corn syrup. Bayer has also pointed out that maize in the USA is treated mainly with new-generation neonicotinoids, rather than with imidacloprid. Opponents argue, however, that these products have similar effects on bees.

Bayer Cropscience cannot easily claim to be unbiased in its criticism of the Harvard study and appears to ignore other research that indicates that the standard tests for pesticide safety fail to take

adequate account of sub-lethal effects and of interactions between different pesticides. Nevertheless, there is clearly a need for further research in order to determine whether neonicotinoids are playing a central role in CCD. A contributory role, in combination with other factors, has been suggested in earlier work by the US Department of Agriculture, as mentioned in *ICN* 64. Such factors are thought to include inadequate diet, parasites such as the varroa mite, microbial diseases, and a loss of genetic diversity. Some of these agents, such as the varroa mite, cannot, however, be blamed for declines in the populations of other kind of bee, as has been pointed out by Matt Shardlow, CEO of Buglife – The Invertebrate Conservation Trust.

The use of neonicotinoids has been strictly limited in France since the 1990s, when they were implicated in mass mortality of bees. In Germany, a ban has been imposed specifically on the use of the neonicotinoid clothianidin as a seed dressing for maize, following mass mortality of bees that came unusually into contact with dust released during the sowing of treated maize seed. Restrictions on seed dressings are also in force in Italy. In the USA, the Environmental Protection Agency is evaluating the safety of neonicotinoids, and more than 1.25 million people have signed petitions requesting a ban. In the UK, the government department DEFRA is quoted as monitoring all the new research into neonicotinoids, and having concluded that all the current evidence shows that "neonicotinoids do not pose an unacceptable risk when products are used correctly".

Matt Shardlow of Buglife has commented that Buglife's review of the science of neonicotinoids and insects in 2009 revealed that a worrying number of studies showed impacts on bees. The review also failed to find any evidence to support the idea that wild pollinators were safe from these pesticides. Matt has added that some neonicotinoids are marketed with boasts of their effectiveness at killing pollinators such as pollen beetles. He argues for a suspension of the use of neonicotinoids on the basis that governments have a duty to impose restrictions where they cannot be sure that a pesticide is environmentally safe.

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Gill, R. J., Ramos-Rodriguez, O. & and N. E. Raine (2012). Combined pesticide exposure severely affects individual - and colony - level traits in bees. *Nature* doi:10.1038/nature11585.

Lu, C. Warchol, K.M. and Callahan, R.A. (2012). *In situ* replication of honey bee colony collapse disorder. *Bulletin of Insectology*, June 2012.

Habitat connections between urban gardens

Amid concerns about urban encroachment on woodland, brownfield and other habitats, it is interesting to see the results of a recent study that highlights the importance of habitat connections between the remaining green spaces that remain within the developed areas. The study is reported in Science for Environment Policy, DG Environment News Alert Service, Issue 291, July 2012.

Many urban green spaces, such as gardens, are small and are separated from one another by buildings and roads. In many towns and cities, they have often been or obliterated or reduced further in size by new developments or by the paving of surfaces. There is widespread recognition of the presumed value of retaining or creating green strips in order to connect fragments of green space. In principle, such "ecological corridors" should improve biodiversity by helping relatively immobile species to disperse within the urban landscape. There has, however, been relatively little research to assess their value in practice.

This study focussed on communities of spiders, carabids (ground beetles), and staphylinids (rove beetles) at four sites near Paris, France. Each site was demarcated in order to include four types of green space: urban woodlands, a woody corridor; a domestic garden connected to the woody corridor and a second type of garden, which was not connected to the woody corridor. The urban woodlands were considered to be the source of the spider and beetle communities. In all, there were four woodland sources, four corridors, 16 connected gardens and 16 unconnected gardens.

The researchers found evidence that corridors were helping to maintain biodiversity. The gardens that were not connected to the woodland contained fewer species of staphylinid beetles and of spiders than in the "connected" gardens or the woodland. The few staphylinids that were found in the unconnected gardens were mainly species with strong dispersal abilities, unlike many of the woodland species. The research group expected to find that woodland carabids would be more adversely affected by a lack of corridors than the woodland staphylinids, since they are generally thought to have poorer powers of dispersal. The total number of carabids was, however found to be generally low; perhaps because of the fragmentation of woodlands at a regional scale.

The species-composition of spiders, carabids and staphylinids in connected gardens was similar to the species-composition found in the corridors. This finding indicated that the corridors support a

community structure as well as providing a means of dispersal. The authors suggest that corridors that connect sources to gardens should be considered an essential part of the wide-scale planning of green spaces in urban areas.

Reference

Vergnes, A., Le Viol, I., Clergeau, P. (2012) Green corridors in urban landscapes affect the arthropod communities of domestic gardens. *Biological Conservation* **145**, 171–178. Doi:10.1016/j.biocon.2011.11.002.

Street lighting affects invertebrate community structure

As set out in last year's report by Buglife on light pollution (Bruce-White & Shardlow, 2011) invertebrates can be adversely affected in a wide variety of ways by artificial light or by reflective structures. One of the most familiar effects is the attraction of flying insects to street lights at night.

Recent evidence of a permanent effect on invertebrates (reported in Science for Environment Policy, DG Environment News Alert Service, Issue 294, 26-Jul-2012) has emerged from a study in Helston in SW England. This indicated that predatory and scavenging insects such as ants, ground beetles, harvestman, ants, woodlice and amphipods were more common under streetlights (spaced at 35-metre intervals) than between the lights. This pattern persisted throughout the day, indicating that lighting induces behavioural disturbances, not only in flying insects, that can lead to permanent changes in community structure.

References

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Davies, T. W., Bennie, J., & Gaston, K. J. (2012). Street lighting changes the composition of invertebrate communities. *Biology Letters*, (May 2012).

FUTURE UK EVENTS

– Wednesday 21st November: One-day brownfield conference hosted by Buglife – The Invertebrate Conservation Trust, for professionals. Location – Green Centre, Wat Tyler Country Park, Basildon, Essex SS16 4UH. Timing: 10 a.m. to 5 p.m. Further details on the Buglife website: booking (online) essential – course fee, 010 including lunch.

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